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10/053,371

Search Results - Record(s) 1 through 35 of 52 returned.

☐ 1. Document ID: US 6462542 B1 Relevance Rank: 99

L1: Entry 12 of 52 File: USPT Oct 8, 2002

US-PAT-NO: 6462542
DOCUMENT-IDENTIFIER: US 6462542 B1

TITLE: Nuclear magnetic resonance measurements and methods of analyzing nuclear magnetic resonance data

DATE-ISSUED: October 8, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Venkataramanan; Lalitha	Stamford	CT		
Song; Yi-Qiao	Ridgefield	CT		
Hurlimann; Martin D.	Ridgefield	CT		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Schlumberger Technology Corporation	Ridgefield	CT			02

APPL-NO: 09/ 909664
DATE FILED: July 20, 2001

PARENT-CASE:
This patent application claims priority from U.S. Provisional Patent Application No. 60/220,053 filed Jul. 21, 2000, which is a continuation of Ser. No. 09/723,803 filed on Nov. 28, 2000, both of which are herein incorporated by reference in their entireties.

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/303; 324/300
US-CL-CURRENT: 324/303; 324/300

FIELD-OF-SEARCH: 324/303, 324/300, 324/306, 324/309, 324/307

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5023551	June 1991	Kleinberg et al.	324/303
5363041	November 1994	Sezginer	324/303
5381092	January 1995	Freedman	324/303
5680043	October 1997	Hurlimann et al.	324/303
5977768	November 1999	Sezginer et al.	324/303
6111409	August 2000	Edwards et al.	324/303
6184681	February 2001	Heidler et al.	324/303

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
2 342 170	May 2000	GB	

OTHER PUBLICATIONS

Journal of the American Chemical Society, 91:27, (1969), pp. 7784-7785, E. D. Becker et al., "A New Method for Nuclear Magnetic Resonance Enhancement".
Journal of Magnetic Resonance, 8, (1972), pp. 298-310, R. R. Shoup et al., "The Driven Equilibrium Fourier Transform NMR Technique: An Experimental Study".
Journal of Magnetic Resonance, 17, (1975), pp. 295-300, R. J. Kurland et al., "The Half-Wave Triplet Pulse Sequence for Determination of Longitudinal Relaxation Rates of Single Line Spectra".
Journal of Magnetic Resonance, 17, (1975), pp. 301-313, H. T. Edzes, "An Analysis of the Use of Pulse Multiplets in the Single Scan Determination of Spin-Lattice Relaxation Rates".
Journal of Molecular Spectroscopy, 35, (1970), pp. 298-305, J. S. Waugh, "Sensitivity in Fourier Transform NMR Spectroscopy of Slowly Relaxing Systems".
Siam J. Numerical Analysis, vol. 18, No. 3, (1981), pp. 381-397, J. P. Butler et al., "Estimating Solutions of First Kind Integral Equations with Nonnegative Constraints and Optimal Smoothing".

ART-UNIT: 2862

PRIMARY-EXAMINER: Lefkowitz; Edward

ASSISTANT-EXAMINER: Shrivastav; Brij B.

ABSTRACT:

Nuclear magnetic resonance measurements on a fluid in a rock and methods of analyzing nuclear magnetic resonance data are described. At least one nuclear magnetic resonance measurement is performed, and nuclear magnetic resonance data from each of the measurements are acquired. The data are compressed and analyzed to extract information about the fluid in the rock.

21 Claims, 11 Drawing figures

☐ 2. Document ID: US 20020105326 A1 Relevance Rank: 99

L1: Entry 6 of 52 File: PGPB Aug 8, 2002

PGPUB-DOCUMENT-NUMBER: 20020105326
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020105326 A1

TITLE: Nuclear magnetic resonance methods for extracting information about a fluid in a rock

PUBLICATION-DATE: August 8, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Hurlimann, Martin D.	Ridgefield	CT	US	
Terneaud, Olivier J.	Saint Avertin	NY	FR	
Freed, Denise	Mount Kisco	CT	US	
Scheven, Ulrich	Bethel	CT	US	
Venkataramanan, Lalitha	Stamford		US	

US-CL-CURRENT: 324/303; 324/306

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Drawi Desc | Image

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☐ 3. Document ID: US 20020067164 A1 Relevance Rank: 99

L1: Entry 8 of 52 File: PGPB Jun 6, 2002

PGPUB-DOCUMENT-NUMBER: 20020067164
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020067164 A1

TITLE: Nuclear magnetic resonance measurements and methods of analyzing nuclear magnetic resonance data

PUBLICATION-DATE: June 6, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Venkataramanan, Lalitha	Stamford	CT	US	
Song, Yi-Qiao	Ridgefield	CT	US	
Hurlimann, Martin D.	Ridgefield	CT	US	

US-CL-CURRENT: 324/307; 324/309

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Drawi Desc | Image

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☑ 4. Document ID: US 20020167317 A1 Relevance Rank: 97

L1: Entry 3 of 52 File: PGPB Nov 14, 2002

PGPUB-DOCUMENT-NUMBER: 20020167317
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020167317 A1

TITLE: Driven equilibrium and fast-spin echo scanning

PUBLICATION-DATE: November 14, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Shenoy, Rajendra K.	Dixhills	NY	US	
Damadian, Jevan	East Northport	NY	US	

US-CL-CURRENT: 324/307; 324/300

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 5. Document ID: US 5303705 A Relevance Rank: 96

L1: Entry 24 of 52 File: USPT Apr 19, 1994

US-PAT-NO: 5303705
DOCUMENT-IDENTIFIER: US 5303705 A

TITLE: Evoked 23NA MR imaging of sodium currents in the brain

DATE-ISSUED: April 19, 1994

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nenov; Valeriy I.	Santa Monica	CA	90403	

APPL-NO: 07/ 877950
DATE FILED: May 1, 1992

INT-CL: [05] A61B 5/055

US-CL-ISSUED: 128/653.2
US-CL-CURRENT: 600/410

FIELD-OF-SEARCH: 128/653.2, 324/307, 324/309

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4409550	October 1983	Fossel	
4710717	December 1987	Pelc et al.	128/653.2
4719425	January 1988	Ettinger	
4779619	October 1988	Winkler	128/653.2
4803432	February 1989	Perman	
4940057	July 1990	Kamei	128/653.2
4982161	January 1991	Twieg	
5076275	December 1991	Bechor et al.	128/653.2

OTHER PUBLICATIONS

Paul J. Keller, Ph.D. "Basic Principles of Magnetic Resonance Imaging", St. Joseph's Hospital Phoenix, AZ, Jun. 1988, pp. 5-29.
Michael K. Stehling, et al., "Echo-Planar Imaging: Magnetic Resonance Imaging in a Fraction of a Second", Science, vol. 254, pp. 43-50, (1991).

Patrick Le Rouz, et al., "Burst Excitation Pulses", Proc. SMRM., 1991, p. 269.
J. Hennig, et al., "Fast Imaging Using Burst Excitation Pulses", Proc. SMRM., 1988, p. 238.
Hilal, S. K. et al., (1987), "Sodium Imaging", in D. D. Stark and W. G. Bradley (eds.), Magnetic Resonance Imaging, pp. 715-791, St. Louis: Mosby.
Camrine, et al., "Intracellular Concentration of Sodium and Other Elements as Related to Mitogenesis and Oncogenesis in Vivo", Cancer Research, 40: 1493-1500 (1980).
Robert B. Lufkin, "Magnetic Resonance Image Formation", in R. B. Lufkin (ed), The MRI Manual, pp. 42-79, Chicago, Illinois Year Book Medical Publishers (1990).
Perman et al., "Methodology of Invivo Human Sodium NMR Imaging at 1.5 Tesla", Radiology, 160:811-820 (1986).
Koester, "Nongated Channels and Passive Membrane Properties of the Neuron", in E. R. Kandel and J. H. Schwartz (eds.), Principles of Neuro Science, pp. 58-65, New York, NY (1985).
Robert P. Crease, "Images of Conflict: MEG vs. EEG", Science, vol. 253, pp. 374-375, Jul. 1991.
S. S. Winkler, et al., "Regional T2 and Sodium Concentration Estimates in the Normal Human Brain by Sodium-23 MR Imaging at 1.5T", Journal of computer Assisted Temo. 561-566 1989.
C. M. J. Van Uijen, et al., "Driven-Equilibrum Radiofrequency Pulses in NMR Imaging", Magnetic Resonance in Medicine 1, 502-507 (1984).
J. B. Ra, et al., "Algorithm for MR Imaging of the Short T2 Fraction of Sodium using the FID Signal", Journal of Computer Assisted Tomography, vol. 13(2), 302-309 (1989).
K. K. Hilal et al., "Vivo NMR Imaging of Sodium-23 in the Human Head", Journal of Computer Assisted Tomography, vol. 9(1), 1-7 (1985).
Bo K. Siesjo, "Brain Energy Metabolism", John Wiley & Sons, 36-37.
S. S. Winkler, "Sodium-23 Magnetic Resonance Brain Imaging", Neuroradiology, 32: 416-420 (1990).

ART-UNIT: 335

PRIMARY-EXAMINER: Smith; Ruth S.

ABSTRACT:

A system and method of Evoked Sodium Magnetic Resonance Imaging (ESMRI) for three-dimensional localization and measurement of sodium currents in the brain during neuronal activity is disclosed. The system measures neuronal activity in response to a stimulus. The sodium MRI measures changes in the sodium concentration due to the influx of sodium into neurons during the generation of synaptic and action potentials. The system measures primarily extracellular sodium which is distinguished from intracellular sodium on the basis of different spin-spin relaxation rates (T2) for these two compartments. Repeated measurements of sodium concentrations are used to produce and display the changes in concentration cinematically. The technique of the present invention is noninvasive and produces three-dimensional brain images with sufficient spatial and temporal resolution to allow three-dimensional visualization of the sequence of neuronal activation in the brain during processing of sensory, motor, cognitive and other tasks.

23 Claims, 8 Drawing figures

☐ 6. Document ID: US 4893081 A Relevance Rank: 95

L1: Entry 29 of 52 File: USPT Jan 9, 1990

US-PAT-NO: 4893081
DOCUMENT-IDENTIFIER: US 4893081 A

TITLE: Driven equilibrium in magnetic resonance imaging

DATE-ISSUED: January 9, 1990

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Zur; Yuval	Hertzlia			IL

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Elscint Ltd.	Haifa			IL	03

APPL-NO: 07/ 330971
DATE FILED: March 30, 1989

PARENT-CASE:
This is a continuation of application Ser. No. 078,889, filed July 29, 1987, now abandoned.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
IL	79732	August 15, 1986

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309
US-CL-CURRENT: 324/309

FIELD-OF-SEARCH: 324/309

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4509015	April 1985	Ordidge	324/309
4532474	July 1985	Edelstein	324/309
4654594	March 1987	Sepponen	324/309
4665365	May 1987	Glover et al.	324/309

OTHER PUBLICATIONS

Article "Drive Equilibrium RF Pulses in NMR Imaging" by Van Uijen, C. M. J. et al., Magnetic Resonance in Medicine, vol. 1, pp. 502-507, (1984).

ART-UNIT: 265

PRIMARY-EXAMINER: Tokar; Michael J.

ASSISTANT-EXAMINER: Fess; Lawrence G.

ABSTRACT:

A Magnetic Resonance (MR) data acquisition system using driven equilibrium in a spin echo scan sequence wherein the dephased spins in the transverse plane are accurately refocused prior to being driven to the Z axis and the encoding gradient pulses are distributed and adjusted to keep the encoding gradient pulses from affecting the refocused magnetization.

19 Claims, 6 Drawing figures

☐ 7. Document ID: US 4788500 A Relevance Rank: 95

L1: Entry 30 of 52 File: USPT Nov 29, 1988

US-PAT-NO: 4788500
DOCUMENT-IDENTIFIER: US 4788500 A

TITLE: Measurement of capillary flow using nuclear magnetic resonance

DATE-ISSUED: November 29, 1988

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Patz; H. Samuel	Wayland	MA		
Hawkes; Robert C.	Dry Drayton			GB2

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Brigham & Women's Hospital	Boston	MA			02

APPL-NO: 07/ 103467
DATE FILED: October 1, 1987

PARENT-CASE:
CROSS-REFERENCE TO OTHER APPLICATIONS This application is a continuation-in-part of U.S. patent application Ser. No. 765,528, filed Aug. 14, 1985, now abandoned.

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309; 128/653, 324/306
US-CL-CURRENT: 324/309; 324/306, 600/419

FIELD-OF-SEARCH: 128/653, 324/306, 324/307, 324/309, 324/311, 324/312

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3191119	June 1965	Singer	324/306
3419793	December 1968	Genthe et al.	324/306
3419795	December 1968	Genthe et al.	324/306
3473108	October 1969	McCormick	324/306
3551794	December 1970	Vander Heyden et al.	324/306
3562632	February 1971	Kirkland	324/306
4015196	March 1977	Moore et al.	324/309
4115730	September 1978	Mansfield	324/309
4165479	August 1979	Mansfield	324/309
4339716	July 1982	Young	324/309
4471305	September 1984	Crooks et al.	324/309
4516582	May 1985	Redington	324/309
4520828	June 1985	Burl et al.	324/306
4528509	July 1985	Radda et al.	324/309
4532473	July 1985	Wehrli	324/306
4532474	July 1985	Edelstein	324/309
4565968	January 1986	Macovski	324/309
4574239	March 1986	Singer	324/306
4574240	March 1986	Libove et al.	324/306
4595879	June 1986	Lent et al.	324/309
4602641	July 1986	Feinberg	324/306
4609872	September 1986	O'Donnell	324/306
4613818	September 1986	Battocletti et al.	324/306
4621234	November 1986	Caprihan	324/306
4629987	December 1986	King et al.	324/306
4639671	January 1987	Macovski	324/309
4665366	May 1987	Macovski	324/307
4685468	August 1987	Macovski	324/309
4707658	November 1987	Frahm et al.	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
1508438	April 1978	GB	

OTHER PUBLICATIONS

Singer and Grover, "Recent Measurements of Flow Using Nuclear Magnetic Resonance Techniques," Modern Developments in Flow Measurement, Clayton Ed., pp. 38-47 (1971).
Garroway, "Velocity Measurements in Flowing Fluids by MNR," Journal of Physics D: Applied Physics, vol. 7, pp. L159-L163 (1974).
Singer, "NMR Diffusion and Flow Measurements and an Introduction to Spin Phase Graphing," J. Phys. I. Sci. Instrumen., vol. 11, pp. 281-291 (1978).
Halbach et al., "Blood Flow Imaging Techniques Using NMR," IEEE 1982, Frontiers of Engineering in Health Care, pp. 1-4 (Sep. 20-21, 1982).
Singer and Crooks, "Nuclear Magnetic Resonance Blood Flow Measurements in The Human Brain," Science, vol. 221, pp. 654-656 (1983).
Singer and Crooks, "Using NMR to Measure Blood Flow Volume and Velocity," VD&T, Jan./Feb. 1984.
Taylor and Bushell, "The Spatial Mapping of Translational Diffusion Coefficients by the NMR Imaging Technique," Phys. Med. Biol., vol. 30, No. 4, pp. 345-349 (1985).
Hinshaw, "Image Formation by Nuclear Magnetic Resonance: The Sensitive Point Method," J. Appl. Phys., 47, 8, pp. 3709-3721 (1976).
Carr, "Steady State Free Precession in Nuclear Magnetic Resonance", Physical Review, vol. 112, No. 5, pp. 1693-1701.
Mansfield and Morris, "3.4 Steady State Free Precession", NMR Imaging in Biomedicine,

Academic Press, 1982, pp. 65-77.
S. Matsui et al., "A New Method of Measuring T.sub.2 Using Steady-State Free Precession", Jnl. Magnetic Resonance 62, 12-18 (1985).

ART-UNIT: 265

PRIMARY-EXAMINER: Levy; Stewart J.

ASSISTANT-EXAMINER: O'Shea; Kevin D.

ABSTRACT:

An improved method for measuring very slow flow rates using nuclear magnetic resonance techniques is disclosed. The basic technique is that of steady state free precession, in which a sequence of radio frequency pulses are applied to nuclei in a magnetic field having a substantial gradient, so that a driven equilibrium state is obtained and which is characterized by a spatial periodicity in the magnetization response of the nuclei. Two images are generated. The two images may be generated using different time intervals between the application of the radio frequency pulses. Alternatively, the two images may be generated using different effective gradients. The spatial periodicity, and the NMR response of flowing nuclei to the spatial periodicity, is thus different during the two image formations. One image is subtracted from the other, which cancels signals from static nuclei in the signal, while relatively fast flowing nuclei, namely in the larger blood vessels or the like, never reach the equilibrium state. The subtraction difference is therefore proportional only to nuclei which are part of relatively slowly flowing liquids, such as in capillary blood flow in organs.

42 Claims, 6 Drawing figures

☐ 8. Document ID: US 4579121 A Relevance Rank: 94

L1: Entry 38 of 52 File: USPT Apr 1, 1986

US-PAT-NO: 4579121
DOCUMENT-IDENTIFIER: US 4579121 A

TITLE: High speed NMR imaging system

DATE-ISSUED: April 1, 1986

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Macovski; Albert	Menlo Park	CA	94025	

APPL-NO: 06/ 467661
DATE FILED: February 18, 1983

INT-CL: [04] A61B 5/04

US-CL-ISSUED: 128/653; 324/309
US-CL-CURRENT: 600/410; 324/309

FIELD-OF-SEARCH: 128/653, 324/309, 324/313-314

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4254778	March 1981	Clow et al.	324/314 X
4284948	August 1981	Young	324/309
4290019	September 1981	Hutchison et al.	324/309 X
4339718	July 1982	Young	324/309
4443760	April 1984	Edelstein et al.	324/314 X
4451788	May 1984	Edelstein et al.	324/309

ART-UNIT: 335

PRIMARY-EXAMINER: Howell; Kyle L.

ASSISTANT-EXAMINER: Jaworski; Francis J.

ABSTRACT:

A cross-sectional image of the NMR activity in the body is formed by taking a sequence of projections, each having a different transverse gradient structure. Following each excitation the spins in the cross section are driven back to equilibrium. For imaging relaxation times, the sequence of projection signals are processed so as to represent an acquisition at a specific desired time.

49 Claims, 8 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 9. Document ID: US 6219571 B1 Relevance Rank: 94

L1: Entry 16 of 52 File: USPT Apr 17, 2001

US-PAT-NO: 6219571
DOCUMENT-IDENTIFIER: US 6219571 B1

TITLE: Magnetic resonance imaging using driven equilibrium fourier transform

DATE-ISSUED: April 17, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hargreaves; Brian A.	Stanford	CA		
Nishimura; Dwight G.	Palo Alto	CA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Board of Trustees of the Leland Stanford Junior University	Palo Alto	CA			02

APPL-NO: 09/ 280223
DATE FILED: March 29, 1999

PARENT-CASE:
This application is a continuation of and claims the benefit of U.S. Provisional Application No. 60/080,904 filed Apr. 6, 1998, the disclosure of which is incorporated

by reference.

INT-CL: [07] A61 B 5/055

US-CL-ISSUED: 600/410; 324/307, 324/309
US-CL-CURRENT: 600/410; 324/307, 324/309

FIELD-OF-SEARCH: 600/410, 324/307, 324/309

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4165479	August 1979	Mansfield	324/309
4509015	April 1985	Ordidge et al.	324/309
4532474	July 1985	Edelstein	324/309
4665365	May 1987	Glover et al.	324/309
4766381	August 1988	Conturo et al.	324/309
4893081	January 1990	Zur	324/309
5245282	September 1993	Mugler, III et al.	324/309
5303705	April 1994	Nenov	600/410

OTHER PUBLICATIONS

Shoup, R.R. et al., "The Driven Equilibrium Fourier Transform NMR Technique: An Experimental Study," Journal of Magnetic Resonance 8, 298-310 (1972).
Iwaoka, Hideto et al., "A New Pulse Sequence for "Fast Recovery" Fast-Scan NMR Imaging," IEEE Transactions on Medical Imaging, vol. MI-3, No. 1, pp. 41-46, Mar. 1984.

Van Uijen, C.M.J. et al., "Driven-Equilibrium Radiofrequency Pulses in NMR Imaging," Magnetic Resonance in Medicine I, 502-507 (1984).
Maki, J.H. et al., "SNR Improvement in NMR Microscopy Using DEFT," Journal of Magnetic Resonance 80, 482-492 (1988).
Rubenstein, Joel D. et al., "Image Resolution and Signal-to-Noise Ratio Requirements for MR Imaging of Degenerative Cartilage," AJR:169, , pp. 1089-1096, Oct. 1997.
Yao, Lawrence et al., "MR Imaging of Joints: Analytic Optimization of GRE Techniques of 1.5 T," AJR:158, pp 339-343 Feb. 1992.
Brittain, Jean H. et al., "Coronary Angiography with Magnetization-Prepared T.sub.2 Contrast," MRM, 33:689-696 (1995).
Henkelman, R.Mark et al., "Anisotropy of NMR Properties of Tissues," MRM 32:592-601 (1994).
Recht, Michael P. et al., "MR Imaging of Articular Cartilage: Current Status and Future Directions," AJR:163-283-290 (1994).
Peterfy, Charles G., et al., "MR Imaging of the Arthritic Knee: Improved Discrimination of Cartilage, Synovium, and Effusion with Pulsed Saturation Transfer and Fat-suppressed T1-weighted Sequences," Radiology 191:413-419 (1994).

ART-UNIT: 377

PRIMARY-EXAMINER: Casler; Brian L.

ABSTRACT:

A new technique for imaging a material with a high T2/T1 ratio such as articular cartilage uses driven equilibrium Fourier transform (DEFT), a method of enhancing signal strength without waiting for full T1 recovery. Compared to other methods, DEFT imaging provides a good combination of bright cartilage and high contrast between cartilage and surrounding tissue. Both theoretical predictions and images show that DEFT is a valuable method for imaging articular cartilage when compared to spoiled gradient recalled acquisition in the steady-state (SPGR) or fast spin echo (FSE). T2-decay, T1 recovery, echo time, magnetization density, proton density, and equilibrium density per proton are related by a derived equation.

16 Claims, 22 Drawing figures

10. Document ID: US 6466013 B1 Relevance Rank: 93

L1: Entry 11 of 52 File: USPT Oct 15, 2002

US-PAT-NO: 6466013
DOCUMENT-IDENTIFIER: US 6466013 B1

TITLE: Nuclear magnetic resonance measurements in well logging using an optimized rephasing pulse sequence

DATE-ISSUED: October 15, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hawkes; Robert	Cambridgeshire			GB
Slade; Robert	Oxfordshire			GB
Lucas; Alun	Cambridgeshire			GB

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Baker Hughes Incorporated	Houston	TX			02

APPL-NO: 09/ 551761
DATE FILED: April 18, 2000

PARENT-CASE:
CROSS REFERENCES TO RELATED APPLICATIONS This application claims priority from U.S. Provisional Patent Application Ser. No. 60/130,005 filed on Apr. 19, 1999.

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/303
US-CL-CURRENT: 324/303

FIELD-OF-SEARCH: 324/303, 324/307, 324/309

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5023551	June 1991	Kleinberg et al.	324/303
5248942	September 1993	Ratzel et al.	324/309
5291137	March 1994	Freedman	324/303
5363041	November 1994	Sezginer	324/303
5381092	January 1995	Freedman	324/303
5486762	January 1996	Freedman et al.	324/303
5680043	October 1997	Hurlimann et al.	324/303
5796252	August 1998	Kleinberg et al.	324/303
6121774	September 2000	Sun et al.	324/303
6133734	October 2000	Mckeon	324/303
6163153	December 2000	Reiderman et al.	324/314
6246236	June 2001	Poitzsch et al.	324/303
6331775	December 2001	Thern et al.	324/303

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
WO 97/34167	September 1997	WO	

OTHER PUBLICATIONS

C. P. Slichter, Principles of Magnetic Resonance, Third Enlarged and Updated Edition, pp. 38-45.
Edwin D. Becker et al.; Driven Equilibrium Fourier Transform Spectroscopy, A New Method for Nuclear Magnetic Resonance Signal Enhancement, 5th Western Regional Meeting of the American Chemical Society, Anaheim, CA, Oct. 7, 1969.
R.R. Ernst; Application of Fourier Transform Spectroscopy to Magnetic Resonance, The Review of Scientific Instruments, pp. 93-102.

ART-UNIT: 2862

PRIMARY-EXAMINER: Lefkowitz; Edward

ASSISTANT-EXAMINER: Vargas; Dixomara

ABSTRACT:

A pulsed NMR tool has a magnet arrangement that is used to generate a static magnetic field having a substantially uniform field strength in a region of the formation surrounding the borehole. An RF coil is used to produce pulsed RF fields substantially orthogonal to the static field in the region of examination. The nuclear spins in the formation align themselves along the externally applied static magnetic field. A pulsed RF field is applied to tip the spins into the transverse plane, resulting in a precession of the spins. The tipping pulse is followed by a series of refocusing pulses and the resulting series of pulse echoes is detected. The timing and duration of RF pulses are altered from conventional CPMG to maximize signal and minimize RF power consumption. An additional forced recovery pulse at the end of an echo train may be used to speed up the acquisition and/or provide a signal for cancelling the ringing artefact.

37 Claims, 18 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

☐ 11. Document ID: US 4254778 A Relevance Rank: 93

L1: Entry 41 of 52 File: USPT Mar 10, 1981

US-PAT-NO: 4254778
DOCUMENT-IDENTIFIER: US 4254778 A

TITLE: Imaging systems

DATE-ISSUED: March 10, 1981

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Clow; Hugh	Maidenhead			GB2
Walters; Peter E.	Southall			GB2
Percival; Wiliam S.	West Ealing			GB2

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
EMI Limited	Hayes			GB2	03

APPL-NO: 06/ 041424
DATE FILED: May 22, 1979

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
GB	22291/78	May 25, 1978

INT-CL: [] A61B 5/05

US-CL-ISSUED: 128/653; 324/314
US-CL-CURRENT: 600/410; 324/309, 324/314

FIELD-OF-SEARCH: 128/653, 324/307, 324/314

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3789832	February 1974	Domadian	128/653

OTHER PUBLICATIONS

Mansfield, P. "Proton Spin Imaging by Nuclear Magnetic Resonance", Contemp. Physics, 1976, vol. 17, No. 6, pp. 553-576.
Becker, E. D. et al., "Driven Equilibrium Fourier Transform Spectroscopy, A New Method for Nuclear Magnetic Resonance Signal Enhancement", Jrnl. of Amer. Chem. Soc., 91:27, Dec. 31, 1969 pp. 7784, 7785.
Easson, R. M., "Design & Performance of Yig-Tuned Gunn Oscillators," Microwave Journal, Feb. 1971, pp. 53-54, 56, 58, 68.
Hoult, D. I., "Zeugmatography; A Criticism of the Concept of a Selective Pulse in the Presence of a Field Gradient," Jrnl. of Mag. Res. 26, 165-167 (1977).

ART-UNIT: 335

PRIMARY-EXAMINER: Michell; Robert W.

ASSISTANT-EXAMINER: Jaworski; Francis J.

ABSTRACT:

In an apparatus for examining human bodies by nuclear magnetic resonance to produce images of cross-sectional slices of such bodies, it is desirable to reduce the recovery time between scans at different angles. A suitable pulse sequence for examination with minimum dispersion is disclosed. Repetition of the sequence with inverted pulses to drive the spins back to equilibrium and reduce recovery time is also disclosed.

9 Claims, 12 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 12. Document ID: US 20020167318 A1 Relevance Rank: 93

L1: Entry 2 of 52 File: PGPB Nov 14, 2002

PGPUB-DOCUMENT-NUMBER: 20020167318
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020167318 A1

TITLE: Method for measuring the magnetic resonance (NMR) by driven equilibrium

PUBLICATION-DATE: November 14, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Hennig, Jurgen	Freiburg		DE	

US-CL-CURRENT: 324/307; 324/309

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 13. Document ID: US 20020167318 A1 EP 1241484 A2 DE 10112704 A1 Relevance Rank: 93

L1: Entry 47 of 52 File: DWPI Nov 14, 2002

DERWENT-ACC-NO: 2002-699876
DERWENT-WEEK: 200277

TITLE: Nuclear magnetic resonance tomography (MRT) using driven equilibrium principles for resonance measurement, with improved sequence weighing generated by alternating pulse flip angles

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw. Desc | Image

☐ 14. Document ID: US 5245282 A Relevance Rank: 72

L1: Entry 27 of 52 File: USPT Sep 14, 1993

US-PAT-NO: 5245282
DOCUMENT-IDENTIFIER: US 5245282 A

TITLE: Three-dimensional magnetic resonance imaging

DATE-ISSUED: September 14, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Mugler, III; John P.	Charlottesville	VA		
Brookeman; James R.	Charlottesville	VA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
University of Virginia Alumni Patents Foundation	Charlottesville	VA			02

APPL-NO: 07/ 723230
DATE FILED: June 28, 1991

INT-CL: [05] G01R 33/20

US-CL-ISSUED: 324/309
US-CL-CURRENT: 324/309

FIELD-OF-SEARCH: 324/300, 324/307, 324/309, 324/312, 324/318, 324/322, 128/653.2

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4797616	January 1989	Matsui et al.	324/309
4801884	January 1989	Oppelt et al.	324/309
4818942	April 1989	Rzedzian	324/312
4830012	May 1989	Riederer	128/653
4833407	May 1989	Holland et al.	324/309
4836209	June 1989	Nishimura	128/653
4843321	June 1989	Sotak	324/309
4856528	August 1989	Yang et al.	128/653
4895157	January 1990	Nambu	128/653
4901019	February 1990	Wedeen	324/309
4940941	July 1990	Rzedzian	324/312
4982161	January 1991	Twieg	324/309
4984573	January 1991	Leunbach	128/653
4986272	January 1991	Riederer et al.	128/653
4991586	February 1991	Mueller et al.	128/653
4993075	February 1991	Sekihara et al.	382/6K
5072182	December 1991	Derby et al.	324/309
5084675	January 1992	Reinfelder et al.	324/309
5087880	February 1992	Bruder et al.	324/309
5105152	April 1992	Pauly	324/309
5122747	June 1992	Reiderer et al.	324/309

ART-UNIT: 263

PRIMARY-EXAMINER: Tokar; Michael J.

ABSTRACT:

A new three-dimensional (3D) MR imaging pulse sequence can produce over 100 high-resolution, high-contrast images in as little as 6 minutes of imaging time. Without additional imaging time, this same image data can be post-processed to yield high-resolution, high-contrast images in any arbitrary orientation. Thus, this new pulse sequence technique provides detailed yet comprehensive coverage. The method of this invention relates to a preparation-acquisition-recovery sequence cycle. The first step is magnetization preparation (MP) period. The MP period can emply a series of RF pulses, gradient field pulses, and/or time delays to encode the desired contrast properties in the form of longitudinal magnetization. A data acquisition period includes at least two repetitions of a gradient echo sequence to acquire data for a fraction of k-space. A magnetization recovery period is provided which allows T1 and T2 relaxation before the start of the next sequence cycle. The MP, data acquisition and magnetization recovery steps are repeated until a predetermined k-space volume is sampled.

44 Claims, 6 Drawing figures

☐ 15. Document ID: US 20020177770 A1 Relevance Rank: 71

L1: Entry 1 of 52 File: PGPB Nov 28, 2002

PGPUB-DOCUMENT-NUMBER: 20020177770

PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020177770 A1

TITLE: Assessing the condition of a joint and assessing cartilage loss

PUBLICATION-DATE: November 28, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Lang, Philipp	Lexington	MA	US	
Steines, Daniel	Palo Alto	CA	US	

US-CL-CURRENT: 600/410

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

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☐ 16. Document ID: US 4665365 A Relevance Rank: 67

L1: Entry 34 of 52 File: USPT May 12, 1987

US-PAT-NO: 4665365
DOCUMENT-IDENTIFIER: US 4665365 A

TITLE: Method for reversing residual transverse magnetization due to phase-encoding magnetic field gradients

DATE-ISSUED: May 12, 1987

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Glover; Gary H.	Waukesha	WI		
Pelc; Norbert J.	Wauwatosa	WI		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
General Electric Company	Milwaukee	WI			02

APPL-NO: 06/ 689428
DATE FILED: January 7, 1985

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309; 324/307
US-CL-CURRENT: 324/309; 324/307

FIELD-OF-SEARCH: 324/300, 324/307, 324/309, 324/313, 324/314, 324/318, 324/322, 324/311

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4484138	November 1984	Bottomley et al.	324/307
4520315	May 1985	Loeffler et al.	324/309
4532474	July 1985	Edelstein	324/309
4602641	July 1986	Feinberg	324/309 X
4609872	September 1986	O'Donnell	324/309 X

ART-UNIT: 265

PRIMARY-EXAMINER: Levy; Stewart J.

ASSISTANT-EXAMINER: Oldham; Scott M.

ABSTRACT:

A method for reversing residual transverse magnetization due to spatial encoding magnetic field gradient pulses, used in magnetic resonance imaging to encode spatial information, employs a reversing gradient pulse applied in the same direction as the encoding gradient pulse following the observation of the spin-echo signal. The encoding gradient pulse is applied following the 180.degree. RF pulse to avoid the effects of imperfections associated therewith. In one embodiment, the amplitudes of the encoding and reversing gradient pulses are selected to be approximately the negatives of each other so as to substantially cancel the residual magnetization. In another embodiment, the amplitude of the reversing gradient pulse is selected such that the algebraic sum thereof with the corresponding amplitude of the encoding gradient pulse is a constant. In this case, the residual magnetization is not necessarily cancelled, but rather, is left in the same state after each view of the pulse sequence. The method is applicable to multiple-echo and driven equilibrium pulse sequences.

10 Claims, 8 Drawing figures

☐ 17. Document ID: US 4651097 A Relevance Rank: 59

L1: Entry 36 of 52 File: USPT Mar 17, 1987

US-PAT-NO: 4651097
DOCUMENT-IDENTIFIER: US 4651097 A

TITLE: Examination method and apparatus utilizing nuclear magnetic resonance

DATE-ISSUED: March 17, 1987

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Iwaoka; Hideto	Tokyo			JP
Sugiyama; Tadashi	Tokyo			JP
Matsuura; Hiroyuki	Tokyo			JP

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Yokogawa Hokushin Electric Corporation	Tokyo			JP	03

APPL-NO: 06/ 659409

DATE FILED: October 10, 1984

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
JP	58-190581	October 12, 1983
JP	59-7707	January 19, 1984

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309; 324/307
US-CL-CURRENT: 324/309; 324/307

FIELD-OF-SEARCH: 324/309, 324/307, 324/311, 324/300

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4115730	September 1978	Mansfield	324/309
4284948	August 1981	Young	324/309
4471305	September 1984	Crooks et al.	324/309
4484138	November 1984	Bottomley et al.	324/307
4502008	February 1985	Ohuchi	324/311
4521733	June 1985	Bottomley et al.	324/309
4532473	July 1985	Wehrli	324/309 X
4532474	July 1985	Edelstein	324/309
4536712	August 1985	Iwaoka et al.	324/309
4549139	October 1985	MacFall et al.	324/309
4567440	January 1986	Haselgrave	324/309
4568880	February 1986	Sugimoto	324/309
4579121	April 1986	Macovsky	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
2089996	June 1982	GB	324/307

OTHER PUBLICATIONS

General Electric, Basic Information About Magnetic Resonance Tomography, General Electric Co., Medical Systems Operations, 1983.

ART-UNIT: 265

PRIMARY-EXAMINER: Tokar; Michael J.

ASSISTANT-EXAMINER: Oldham; Scott M.

ABSTRACT:

In an examination method and apparatus utilizing nuclear magnetic resonance, high frequency pulses for producing nuclear magnetic resonance are applied by successively imposing a first 90.degree. pulse, a first 180.degree. pulse, a second 90.degree. pulse, and a second 180.degree. pulse substantially immediately after the second 90.degree. pulse, and a next pulse sequence is initiated upon elapse of a wait time after the second 180.degree. pulse has been applied. The wait time is rendered much shorter than the conventional prior art wait times for high speed scanning operation, by forcibly aligning magnetization M first with the direction of a -Z direction axis

and then with the direction of a +Z direction axis, using the second 90.degree. pulse and the second 180.degree. pulse. By applying a number of first 180.degree. pulses, a number of nuclear magentic resonance signals are produced for additionally shortening the overall measurement time.

47 Claims, 45 Drawing figures

☐ 18. Document ID: US 5825185 A Relevance Rank: 58

L1: Entry 19 of 52 File: USPT Oct 20, 1998

US-PAT-NO: 5825185
DOCUMENT-IDENTIFIER: US 5825185 A

TITLE: Method for magnetic resonance spin echo scan calibration and reconstruction

DATE-ISSUED: October 20, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Liu; Haiying	Minneapolis	MN		
Bearden; Francis H.	Twinsburg	OH		
DeMeester; Gordon D.	Wickliffe	OH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Picker International, Inc.	Highland Heights	OH			02

APPL-NO: 08/ 757153
DATE FILED: November 27, 1996

INT-CL: [06] G01 V 3/00

US-CL-ISSUED: 324/309; 324/307
US-CL-CURRENT: 324/309; 324/307

FIELD-OF-SEARCH: 324/309, 324/307, 324/306, 324/314, 324/300, 324/312

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4851779	July 1989	DeMeester et al.	324/309
5138259	August 1992	Schmitt et al.	324/309
5581184	December 1996	Heid	324/309
5621321	April 1997	Liu et al.	324/307
5742163	April 1998	Liu et al.	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0296834A3	December 1988	EP	
0296834A2	December 1988	EP	
0490528A1	June 1992	EP	
0772057A1	July 1997	EP	
4005675A1	August 1991	DE	
4445782C1	July 1996	DE	

OTHER PUBLICATIONS

Hennig, J., et al. "RARE Imaging: A Fast Imaging Method for Clinical MR," Mag. Res. Med., 3, pp. 823-833 (1986).
Mulkern, R.V., et al., "Contrast Manipulation and Artifact Assessment of 2D and 3D Rare Sequences," Mag. Res. Imaging, 8, pp. 557-566 (1990).
Zhou, et al., "On Phase Artifacts of High-Field Fast Spin-Echo Images," SMRI Abstract Book, p. 1248 (Aug. 1993).
Zhou, et al., "Reduction of Ringing and Blurring Artifacts in Fast Spin-Echo Images," SMRI Abstract Book, p. 935 (Aug. 1993).
Zhou, et al., "Reduction of Ringing and Blurring Artifacts in Fast Spin-Echo Images," J. Mag. Res. Imaging, 3, pp. 803-807 (Sep./Oct. 1993).
Wan, et al., "Reduction of Phase Error Ghosting Artifacts in Thin Slice Fast Spin-Echo Imaging," Mag. Res. Med., 34, pp. 632-638 (1995).
Press, et al. "Numerical Recipes in Fortran: The Art of Scientific Computing,"2nd. ed. (1992).
XP002057350 2D Phase Correction For Multiple Shot EPI, Haiying Liu, et al. Proceedings International Society Magnetic Resonance Medicine, vol. 3.
XP002057349 Cross-Correlation in MRI: Image Reg., P.V. Connaughton, et al. Book of Abstracts vol. 2, Society Magnetic Resonance Medicine and Biology.

ART-UNIT: 287

PRIMARY-EXAMINER: Arana; Louis M.

ABSTRACT:

A transmitter (24) and gradient amplifiers (20) transmit radio frequency excitation and other pulses to induce magnetic resonance in selected magnetic dipoles and cause the magnetic resonance to be focused into a series of echoes (66) at each of a plurality of preselected echo positions following each excitation. A receiver (38) converts each echo into a data line. Calibration data lines having a close to zero phase-encoding are collected and used to generate correction parameters (102) for each of the echo positions. These parameters include relative echo center positions (96) and unitary complex correction vectors (106). The calibration data lines for each of the preselected positions are one-dimensionally Fourier transformed (82) and multiplied (90) by the same complex conjugate reference echo (80). These data lines are then inverse Fourier transformed (92) to generate an auxiliary data array (94). A relative echo center position is computed (96) which represents a fractional shift of the true center relative to the reference echo. A complex sum is computed (104) from the relative echo center position and normalized (106) to generate a unitary correction vector. The phase-correction parameters are used to phase-correct (116) imaging data lines. The phase-corrected imaging data lines are sorted (122) to build an image plane which is one-dimensionally Fourier transformed (128) in the phase-encoding direction to produce a final corrected image (130) for display on a monitor (134).

18 Claims, 7 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw Desc | Image

☐ 19. Document ID: US 4766381 A Relevance Rank: 58

L1: Entry 31 of 52 File: USPT Aug 23, 1988

US-PAT-NO: 4766381
DOCUMENT-IDENTIFIER: US 4766381 A

TITLE: Driven inversion spin echo magnetic resonance imaging

DATE-ISSUED: August 23, 1988

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Conturo; Thomas E.	Nashville	TN		
Kessler; Robert M.	Nashville	TN		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Vanderbilt University	Nashville	TN			02

APPL-NO: 07/ 084575
DATE FILED: August 12, 1987

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309
US-CL-CURRENT: 324/309

FIELD-OF-SEARCH: 324/307, 324/309, 324/312, 128/657

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4254778	March 1981	Clow et al.	128/653
4558277	December 1985	Post et al.	324/309
4703270	October 1987	Hall et al.	324/309

OTHER PUBLICATIONS

Mitchell et al., Invest. Gative Raviology, vol. 19, No. 5, pp. 350-360 (1984).
Jensen et al., Medical Physics 14, 38-42 (1987).
M. H. Levitt et al., Journal of Magnetic Resonance, 33, 473 (1979).
ED2EJ, H. T. J. of Magnetic Resonance, 17, 301 (1975).
Bydder et al., Journal of Computer Assisted Tomography, 9, 659-675 (1985).
Driven Equilibrium Fourier Transform Spectroscopy, Becker et al., Jour. of Amer. Chem. Soc. 91:27, 12/31/69.

ART-UNIT: 265

PRIMARY-EXAMINER: Levy; Stewart J.

ASSISTANT-EXAMINER: O'Shea; Kevin D.

ABSTRACT:

A method of inversion spin echo magnetic resonance imaging includes providing a specimen positioned within a main magnetic field, a source of RF signals, a receiver for receiving signals emitted from the specimen responsive to the RF pulses and emitting responsive output signals, a computer for receiving the output signals from the receiver and establishing image information related thereto and a visual display for displaying images obtained from the image information. During an initial echo

period, imposing three pulses on the main magnetic field with the first and third pulses having a first value and the second pulse having a second value which may be approximately double the first value, creating an echo with the second pulse and the third pulse converting this echo into negative longitudinal magnetization. After an inversion period during a second echo period imposing fourth and fifth RF pulses in the same sequence and generally of magnitude as the first and second pulses, respectively, creating a spin echo with the fifth pulse and response to said spin echo emitting output information from the receiver means to the computer with the computer establishing image information which is delivered to the visual display. The apparatus provides magnetic field generation apparatus to provide a main magnetic field on a specimen and RF signal generating apparatus for emitting pulsed RF signals in order to establish predetermined pulse sequences and magnitudes with the resultant receiver and computer serving to convert the same into image information for visual display.

47 Claims, 5 Drawing figures

☐ 20. Document ID: US 5742163 A Relevance Rank: 58

L1: Entry 20 of 52 File: USPT Apr 21, 1998

US-PAT-NO: 5742163
DOCUMENT-IDENTIFIER: US 5742163 A

TITLE: Magnetic resonance scan calibration and reconstruction technique for multi-shot, multi-echo imaging

DATE-ISSUED: April 21, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Liu; Haiying	Euclid	OH		
DeMeester; Gordon D.	Wickliffe	OH		
McNally; James M.	Chagrin Falls	OH		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Picker International, Inc.	Highland Heights	OH			02

APPL-NO: 08/ 638643
DATE FILED: April 26, 1996

INT-CL: [06] G01 V 3/00

US-CL-ISSUED: 324/309; 324/307
US-CL-CURRENT: 324/309; 324/307

FIELD-OF-SEARCH: 324/309, 324/307, 324/306, 324/314, 324/312, 324/300, 128/653.2

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5151656	September 1992	Maier et al.	324/309
5531223	July 1996	Hatanaka	324/309
5557204	September 1996	Lenz	324/309
5581184	December 1996	Heid	324/309
5652514	July 1997	Zhang et al.	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 250 050	December 1987	EP	
0 280 310	August 1988	EP	

OTHER PUBLICATIONS

"Cartesian Echo Planar Hybrid Scanning with Two to Eight Echoes", Kashmar, et al. IEEE Trans on Medical Imaging, V. 10, N. 1, Mar. 1991.
"Interleaved Echo Planar Imaging on a Standard MRI System", Butts, et al. MRM 31:677-72 (1994).
"Ultrafast Interleaved Gradient-Echo-Planar Imaging on a Standard Scanner", McKinnon, MRM 30:609-616 (1993).

ART-UNIT: 225

PRIMARY-EXAMINER: Arana; Louis M.

ABSTRACT:

A sequence control (40) causes a transmitter (24) and gradient amplifiers (20) to transmit radio frequency excitation and other pulses to induce magnetic resonance in selected dipoles and cause the magnetic resonance to be focused into a series of echoes in each of a plurality of data collection intervals following each excitation. A receiver (38) converts each echo into a data line. Calibration data lines having a close to zero phase-encoding are collected during each of the data collection intervals. The calibration data lines in each data collection interval are zero-filled (86) to generate a complete data set and Fourier transformed (88) into a series of low resolution complex images (90.sub.1, 90.sub.2, . . . 90.sub.n), each corresponding to one of the data collection intervals. The low resolution images are normalized (92) and their complex conjugates taken (94). Imaging data lines are sorted by a data collection interval and zero-filled (104) to create full data sets. The full data set corresponding to each data sampling interval is Fourier transformed into partial image representations (106.sub.1, 106.sub.2, 106.sub.n). Each partial image is multiplied (108) by a complex conjugate of the normalized phase correction map (96) to create corrected partial images which are summed (112) to generate a composite image (114). The composite images are density corrected (120).

20 Claims, 11 Drawing figures

☐ 21. Document ID: US 5397562 A Relevance Rank: 58

L1: Entry 22 of 52 File: USPT Mar 14, 1995

US-PAT-NO: 5397562
DOCUMENT-IDENTIFIER: US 5397562 A

TITLE: Use of .sup.19 F magnetic resonance to non-invasively assess pO.sub.2 and temperature in vivo

DATE-ISSUED: March 14, 1995

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Mason; Ralph P.	Irving	TX		
Antich; Peter P.	Richardson	TX		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Board of Regents, The University of Texas System	Austin	TX			02

APPL-NO: 08/ 092122
DATE FILED: July 15, 1993

PARENT-CASE:
This is a continuation-in-part of application Ser. No. 482,879, filed on Feb. 21, 1990, now U.S. Pat. No. 5,236,694. That application is incorporated here by reference.

INT-CL: [06] A61 B 5/055

US-CL-ISSUED: 424/9; 436/173, 128/653.4, 514/832
US-CL-CURRENT: 424/9.37; 436/173, 514/832, 600/412, 600/420

FIELD-OF-SEARCH: 424/9, 436/173, 128/653.4, 128/654, 514/832

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4558279	December 1985	Ackerman et al.	324/315
4586511	May 1986	Clark, Jr.	128/653
4612185	September 1986	Dean	424/2
4631190	December 1986	Shen et al.	424/85
4639364	January 1987	Hoey	424/9
4640833	February 1987	Tamborski et al.	424/5
4741900	May 1988	Alvarez et al.	424/85
4838274	June 1989	Schweighardt et al.	128/654
5068098	November 1991	Schweighardt et al.	424/9
5080885	January 1992	Long, Jr.	424/5
5116599	May 1992	Rogers, Jr. et al.	424/9
5130119	July 1992	Blaszkiewicz et al.	424/9
5196348	March 1993	Schweighardt et al.	436/173
5236694	August 1993	Antich et al.	424/9

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0186947	October 1985	EP	
WO89/02931	April 1989	WO	

OTHER PUBLICATIONS

Levy et al, "Synthesis and Characterization of .sup.19 F NMR Chelators for Measurement of Cytosolic Free Ca," Amer. Physiol. Soc., 252:4, pp. C441-C449 (Apr. 1987).
Hamza et al, "Solute-Solvent Interactions in Perfluorocarbon Solutions of Oxygen," J. Am. Chem. Soc. 103:3733-3738 (1981).
Mason et al., "A Novel Editing Technique for .sup.19 F MRI: Molecule-Specific Imaging", Magnetic Resonance Imaging, 8:729-736, (1990).
Jeffrey et al., "Rapid Non-invasive Assessment of Myocardial pO2 Using .sup.19 F NMR Spectroscopy of Sequestered Perfluorocarbon Emulsion", Abstracts of the 63rd Scientific Sessions, III-685, No. 2722; Circulation, 1990, vol. 82, No. 4.
Parhami et al., "Fluorine-19 Relaxation Study of Perfluoro Chemicals as Oxygen Carriers," J. Phys. Chem. 87:1928-1938 (1983).
Mason et al., Abstract, "A Non-Invasive Assessment of Myocardial Oxygen Tension," Society of Magnetic Resonance in Medicine, Ninth Annual Meeting (Aug. 18-24, 1990).
Mason et al., "Tissue Oxygenation: A Novel Determination Using .sup.19 F Surface Coil NMR Spectroscopy of Sequestered Perfluorocarbon Emulsion," Magnetic Resonance in Medicine, 18:71-79 (1991).
Berkowitz, "Quantitative Determination of the Partial Oxygen Pressure in the Vitrectomized Rabbit Eye in Vivo Using .sup.19 F NMR," Magnetic Resonance Medicine, 21:233-241 (1991).
Mason et al., Abstract, "Simultaneous Oxygen Tension and Temperature Measurements: A Novel Non-Invasive Technique," 9th International Congress of Radiation Research (1991).

Mason et al., "A Noninvasive Assessment of Myocardial Oxygen Tension: .sup.19 F NMR Spectroscopy of Sequested Perfluorocarbon Emulsion," Magnetic Resonance in Medicine, 27:310-317 (1992).
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Mason et al, "Tumor Oxygen Tension Gradients: New Evidence From .sup.19 F MRI of Perfluorocarbons," Abstract of Papers for the 41st Annual Meeting of Radiation Research Society and the 13th Annual Meeting of the North American Hyperthermia Society, Dallas, Tex., (Mar. 20-25, 1993).
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Mason et al., "In Vivo Oxygen Tension and Temperature: Stimulaneous Determination Using .sup.19 F NMR Spectroscopy of Perfluorocarbon," 1991, Society of Magnetic Resonance in Medicine.
Mehta et al, "New .sup.19 F Magnetic Resonance Imaging Agents for Drug Targeting," Proceedings of the 38th Annual Meeting 32:5, No. 731 (May, 1991).
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"Modified Antibody for NMR Diagnostic Method-Comprises Reactive Antibody Modified with Flourine cpd," Derwent Abstract, No. 88-195824 (Asahi Kasei Kogyo, 7 Jun. 1988).

ART-UNIT: 129

PRIMARY-EXAMINER: Hollinden; Gary E.

ABSTRACT:

Oxygen tension of tissue in a living subject may be determined non-invasively by a method which involves: administering to a living mammalian subject a biologically compatible perfluorocarbon emulsion in an amount effective to generate a measurable .sup.19 F spectrum under .sup.19 F NMR spectroscopy; allowing sufficient time to elapse for substantially all of the perfluorocarbon emulsion to be cleared from the vascular system of the subject, with a portion of the perfluorocarbon emulsion becoming sequestered in tissue of the subject; subjecting the tissue in which the perfluorocarbon emulsion has become sequestered to a .sup.19 F magnetic resonance spectroscopy procedure in which simultaneous measurements are made of spin-lattice relaxation rates for at least two separate resonances of the perfluorocarbon emulsion; and comparing the at least two spin-lattice relaxation rates measured in the .sup.19 F magnetic resonance spectroscopy procedure to a predetermined relation of spin-lattice relaxation rate to oxygen tension and temperature for the perfluorocarbon emulsion used, and thereby determining the oxygen tension and temperature of the tissue.

7 Claims, 29 Drawing figures

☐ 22. Document ID: US 4509015 A Relevance Rank: 57

L1: Entry 39 of 52 File: USPT Apr 2, 1985

US-PAT-NO: 4509015
DOCUMENT-IDENTIFIER: US 4509015 A

TITLE: Nuclear magnetic resonance methods

DATE-ISSUED: April 2, 1985

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ordidge; Roger J.	Stapleford, Nottingham, Nottinghamshire			GB2
Mansfield; Peter	Beeston, Nottingham, Nottinghamshire			GB2

APPL-NO: 06/ 418641
DATE FILED: September 16, 1982

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
GB	8128524	September 21, 1981

INT-CL: [03] G01R 33/08

US-CL-ISSUED: 324/309; 324/307
US-CL-CURRENT: 324/309; 324/307

FIELD-OF-SEARCH: 324/300, 324/307, 324/309, 324/311

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4318043	March 1982	Crooks	324/309
4355282	October 1982	Young	324/309

ART-UNIT: 267

PRIMARY-EXAMINER: Tokar; Michael J.

ABSTRACT:

This invention provides methods of investigating a body by nuclear magnetic resonance. Nuclear magnetic resonance is preferentially excited in a slice of the body and the resulting free induction decay signals are detected in the presence of a magnetic field having first and second gradients (G.sub.y, G.sub.x).

In one proposed method two experiments are performed in which the phase of the first gradient (G.sub.y) reversal is opposite, and the detected signals from the two experiments are edited to obtain a set of signals, for Fourier transformation, occurring when the first gradient has one sense. Two such sets may be obtained, one for each sense of the first gradient, and the data obtained after Fourier transformation re-ordered and added.

In a second proposed method the second gradient (G.sub.x) is applied only when the first gradient (G.sub.y) has a given sense, and the free induction decay signals obtained when both gradients are present, and when only the first gradient is present, are separately processed.

In a third proposed method, the first gradient (G.sub.y) is temporarily removed before each reversal of its sense, and the second gradient (G.sub.x) is reversed while the first gradient is removed, the magnitude of the second gradient being controlled so that the time integral of the second gradient at the beginning of each period when the first gradient has a given sense is the same as at the end of the preceding such period, the free induction decay signals occurring when the first gradient has said given sense only being used for data retrieval.

19 Claims, 11 Drawing figures

☐ 23. Document ID: US 4906931 A Relevance Rank: 56

L1: Entry 28 of 52 File: USPT Mar 6, 1990

US-PAT-NO: 4906931
DOCUMENT-IDENTIFIER: US 4906931 A

TITLE: Apparatus and method for the examination of properties of an object

DATE-ISSUED: March 6, 1990

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Sepponen; Raimo	Helsinki			FI

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Instrumentarium Corp.				FI	03

APPL-NO: 07/ 255233
DATE FILED: October 11, 1988

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
FI	874419	October 8, 1987

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309
US-CL-CURRENT: 324/309

FIELD-OF-SEARCH: 324/300, 324/307, 324/309, 324/318, 324/319, 324/320, 324/322, 128/653

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3774103	November 1973	Laukien	324/307
4587488	May 1986	Young	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
1461077	November 1973	GB	

ART-UNIT: 265

PRIMARY-EXAMINER: Tokar; Michael J.

ABSTRACT:

The invention relates to an apparatus for the examination of an object by the application of methods, such as magnetic imaging, based on nuclear magnetic resonance. The apparatus includes means for creating a first magnetic field over an object to be examined as well as means for creating and registering a nuclear magnetic resonance signal. The apparatus further includes means for creating a second magnetic field in a manner that the formation of nuclear magnetization occurring between successive excitation and signal pick-up events is at least partially effected while the second magnetic field is switched on.

14 Claims, 10 Drawing figures

☐ 24. Document ID: US 5908386 A Relevance Rank: 56

L1: Entry 18 of 52 File: USPT Jun 1, 1999

US-PAT-NO: 5908386
DOCUMENT-IDENTIFIER: US 5908386 A

TITLE: Fast MRI for assessment of myocardial perfusion with arrythmia insensitive magnetization preparation

DATE-ISSUED: June 1, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Ugurbil; Kamil	Minneapolis	MN		
Tsekos; Nikolaos V.	Minneapolis	MN		
Garwood; Michael G.	Medina	MN		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Regents of the Universotiy of Minnesota	Minneapolis	MN			02

APPL-NO: 08/ 766863
DATE FILED: December 13, 1996

PARENT-CASE:
This application claims the benefit of U.S. Provisional Application No. 60/008,642 filed Dec. 14, 1995.

INT-CL: [06] A61 B 5/055

US-CL-ISSUED: 600/410; 600/419, 324/306
US-CL-CURRENT: 600/410; 324/306, 600/419

FIELD-OF-SEARCH: 128/653.2, 128/653.3, 324/306, 324/309, 600/410, 600/419, 600/420

PRIOR-ART-DISCLOSED:

OTHER PUBLICATIONS

Haase, A., "Snapshot FLASH MRI. Applications to T1, T2, and Chemical-Shift Imaging", Magnetic Resonance in Medicine 13, 77-89, (1990).
Tsekos, N.V., et al., "Fast Anatomical Imaging of the Heart and Assessment of Myocardial Perfusion with Arrhythmia Insensitive Magnetization Preparation", Magnetic Resonance In Medicine, 34, 530-536, (1995).
Wilke, N., et al., "Concepts of Myocardial Perfusion Imaging in Magnetic Resonance Imaging", Magnetic Resonance in Medicine, 10, 249-286, (1994).

ART-UNIT: 377

PRIMARY-EXAMINER: Manuel; George

ASSISTANT-EXAMINER: Shaw; Shawna J.

ABSTRACT:

Contrast preparation based on Modified Driven Equilibrium Fourier Transfer generates T1 weighted images for assessment of the myocardial perfusion with contrast agent first-pass kinetics. The preparation scheme produces T1 contrast with insensitivity to arrhythmias in prospectively triggered sequential imaging thereby eliminating one of the major sources of problems in potential patient studies with previously employed contrast preparations schemes.

29 Claims, 15 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWMC | Draw Desc | Image

☐ 25. Document ID: US 6369569 B1 Relevance Rank: 56

L1: Entry 15 of 52 File: USPT Apr 9, 2002

US-PAT-NO: 6369569
DOCUMENT-IDENTIFIER: US 6369569 B1

TITLE: Magnetic resonance tomography apparatus and operating method for displaying tissue contrasts with a short measuring time

DATE-ISSUED: April 9, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Heid; Oliver	Gunzenhausen			DE

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Siemens Aktiengesellschaft	Munich			DE	03

APPL-NO: 09/ 487279
DATE FILED: January 19, 2000

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
DE	199 03 029	January 26, 1999

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/309; 324/318, 324/307
US-CL-CURRENT: 324/309; 324/307, 324/318

FIELD-OF-SEARCH: 324/309, 324/307, 324/310, 324/318

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4707658	November 1987	Frahm et al.	324/309
4982161	January 1991	Twieg	324/309
5541514	July 1996	Heid et al.	324/309

ART-UNIT: 2862

PRIMARY-EXAMINER: Patidar; Jay

ASSISTANT-EXAMINER: Shrivastav; Brij B.

ABSTRACT:

In a magnetic resonance imaging method and apparatus, a measuring cycle of successive pulse sequences with an RF excitation pulse and magnetic field gradient pulses for rephasing the nuclear magnetization of an examination subject is generated, and the measuring cycle is interrupted after a defined number of repetitions of the successive pulse sequences before reaching a dynamic steady state, and is restarted later.

7 Claims, 5 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

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☐ 26. Document ID: US 20010041833 A1 Relevance Rank: 56

L1: Entry 10 of 52 File: PGPB Nov 15, 2001

PGPUB-DOCUMENT-NUMBER: 20010041833
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20010041833 A1

TITLE: Method of magnetic resonance imaging

PUBLICATION-DATE: November 15, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Bjornerud, Atle	Oslo	NJ	NO	
Kellar, Kenneth Edmund	Flemington		US	
Briley-Saebo, Karen	Oslo		NO	
Johansson, Lars	Uppsala		SE	

US-CL-CURRENT: 600/420; 600/431

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

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☐ 27. Document ID: US 4716367 A Relevance Rank: 55

L1: Entry 32 of 52 File: USPT Dec 29, 1987

US-PAT-NO: 4716367
DOCUMENT-IDENTIFIER: US 4716367 A

TITLE: Creation and use of a moving reference frame for NMR imaging of flow

DATE-ISSUED: December 29, 1987

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Patz; H. Samuel	Wayland	MA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Brigham & Women's Hospital	Boston	MA			02

APPL-NO: 06/ 896814
DATE FILED: August 15, 1986

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309; 324/306
US-CL-CURRENT: 324/309; 324/306

FIELD-OF-SEARCH: 324/300, 324/306, 324/307, 324/309, 324/318, 324/322, 128/653

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3191119	June 1965	Singer	
3419793	December 1968	Genthe et al.	
3419795	December 1968	Genthe et al.	
3473108	October 1969	McCormick	
3551794	December 1970	Vander Heyden et al.	
3562632	February 1971	Kirkland	
4015196	March 1977	Moore et al.	
4471305	September 1984	Crooks et al.	
4516582	May 1985	Redington	
4520828	June 1985	Burl et al.	
4528509	July 1985	Radda et al.	
4532473	July 1985	Wehrli	324/306
4532474	July 1985	Edelstein	
4574239	March 1986	Singer	324/306
4574240	March 1986	Libove et al.	
4595879	June 1986	Lent et al.	
4602641	July 1986	Feinberg	
4609872	September 1986	O'Donnell	324/306
4613818	September 1986	Battocletti	324/306
4621234	November 1986	Caprihan	324/306
4629987	December 1986	King et al.	324/306
4638251	January 1987	King	324/300
4639671	January 1987	Macovski	324/306

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
1508438	April 1978	GB	

OTHER PUBLICATIONS

Singer and Grover, "Recent Measurements of Flow Using Nuclear Magnetic Resonance Techniques", Modern Developments in Flow Measurement, Clayton Ed., pp. 38-47 (1971).
Garroway, "Velocity Measurements in Flowing Fluids by MNR", Journal of Physics D: Applied Physics, vol. 7, pp. L159-L163 (1974).
Singer, "NMR Diffusion and Flow Measurements and an Introduction to Spin Phase Graphing", J. Phys. I. Sci. Instrumen., vol. 11, pp. 281-291 (1978).
Halbach et al., "Blood Flow Imaging Techniques Using NMR", IEEE 1982 Frontiers of Engineering in Health Care, pp. 1-4 (Sep. 20-21, 1982).
Singer and Crooks, "Nuclear Magnetic Resonance Blood Flow Measurements in The Human Brain", Science, vol. 221, pp. 654-656 (1983).
Singer and Crooks, "Using NMR to Measure Blood Flow Volume and Velocity", VD&T, Jan./Feb. 1984.
Taylor and Bushell, "The Spatial Mapping of Translational Diffusion Coefficients by the NMR Imaging Technique", Phys. Med. Biol., vol. 30, No. 4, pp. 345-349 (1985).
Hinshaw, "Image Formation by Nuclear Magnetic Resonance: The Sensitive Point Method", J. Appl. Phys., 47, 8, pp. 3709-3721 (1976).
Carr, "Steady State Free Precession in Nuclear Magnetic Resonance", Physical Review,

vol. 112, No. 5, pp. 1693-1701.
Mansfield and Morris "3.4 Steady State Free Precession", NMR Imaging in Biomedicine, Academic Press, 1982, pp. 65-77.

ART-UNIT: 265

PRIMARY-EXAMINER: Tokar; Michael J.

ABSTRACT:

The present invention provides an NMR image in which the individual image element intensities are proportional to the amount of nuclei flowing within a window of velocities. The invention is predicated on the fact that static nuclei in a static reference frame provide the most intense portions of the NMR signal. A moving reference frame for image creation is created moving at the velocity of the nuclei to be imaged. Nuclei moving at the same velocity as the reference frame thus have zero velocity with respect to the reference frame, and hence provide maximum signal intensity. In the described embodiment, the moving reference frame is created by satisfaction of two conditions, which relate to tracking the Larmor frequency and phase of the nuclei of interest moving in a gradient. These conditions may be satisfied by variation of the main NMR magnetic field H.sub.o as a function of time. The field may be varied simply by addition of an additional coil to conventional NMR equipment. The invention is applicable to image formation using either steady state free precession techniques or conventional spin echo techniques.

33 Claims, 12 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

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☐ 28. Document ID: US 20020087274 A1 Relevance Rank: 55

L1: Entry 7 of 52 File: PGPB Jul 4, 2002

PGPUB-DOCUMENT-NUMBER: 20020087274
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020087274 A1

TITLE: Assessing the condition of a joint and preventing damage

PUBLICATION-DATE: July 4, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Alexander, Eugene J.	San Francisco	CA	US	
Andriacchi, Thomas P.	Los Altos Hills	CA	US	
Lang, Philipp	San Francisco	CA	US	
Napel, Sandy A.	Menlo Park	CA	US	

US-CL-CURRENT: 702/19; 378/3

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC | Draw Desc | Image

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☐ 29. Document ID: US 5655531 A Relevance Rank: 55

L1: Entry 21 of 52 File: USPT Aug 12, 1997

US-PAT-NO: 5655531
DOCUMENT-IDENTIFIER: US 5655531 A

TITLE: MRI method and apparatus for selective image suppression of material based on T1 and T2 relation times

DATE-ISSUED: August 12, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nishimura; Dwight G.	Palo Alto	CA		
Brittain; Jean H.	Stanford	CA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
The Board of Trustees of the Leland Stanford Junior University	Palo Alto	CA			02

APPL-NO: 08/ 441101
DATE FILED: May 15, 1995

INT-CL: [06] A61 B 5/055

US-CL-ISSUED: 128/653.2; 324/307, 324/309
US-CL-CURRENT: 600/413; 324/307, 324/309

FIELD-OF-SEARCH: 128/653.2, 324/307, 324/309

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4684892	August 1987	Graumann	
5248942	September 1993	Ratzel et al.	
5565776	October 1996	Kanazawa	
5570019	October 1996	Moonen et al.	
5588431	December 1996	Marii et al.	
5594336	January 1997	Gullapalli	

OTHER PUBLICATIONS

Brittain et al., Coronary Antiography With Magnetization-Prepared T2 Contrast, Magnetic Resonance in Medicine in Medicine, vol. 33, No. 5, May 1995, pp. 689-696.
Brittain et al., Three-Dimensional Flow-Independent Peripheral Angiography, SRM, to appear Aug. 1995, 1 page.
Brittain et al., Coronary Angiography with Magnetization-Prepared T2 Contrast, MRM, to appear, 1995.

ART-UNIT: 335

PRIMARY-EXAMINER: Lateef; Marvin M.

ASSISTANT-EXAMINER: Shaw; Shawna J.

ABSTRACT:

The selective imaging of an object having two materials with different relaxation times

(T1 or T2) is provided by using a driven equilibrium sequence (T2 weighted preparation sequence) followed by an inversion recovery sequence. In the driven equilibrium sequence the object is placed in a static magnetic field along a longitudinal axis, an excitation pulse is applied to tip nuclei spins into a transverse plane, and at least one refocusing pulse is applied to produce a spin echo having a magnetization component as a function of relaxation time. At least one pulse is then applied to the object to drive the spin echo to an inverted position along the longitudinal axis. A readout excitation is then applied at a later time when the longitudinal magnetization of one material is substantially reduced. In one embodiment, an inversion pulse is applied prior to the T2 weighted preparation sequence.

12 Claims, 6 Drawing figures

☐ 30. Document ID: US 4665366 A Relevance Rank: 54

L1: Entry 33 of 52 File: USPT May 12, 1987

US-PAT-NO: 4665366
DOCUMENT-IDENTIFIER: US 4665366 A

TITLE: NMR imaging system using phase-shifted signals

DATE-ISSUED: May 12, 1987

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Macovski; Albert	Menlo Park	CA	94025	

APPL-NO: 06/ 710484
DATE FILED: March 11, 1985

INT-CL: [04] G01R 33/20

US-CL-ISSUED: 324/309; 324/307
US-CL-CURRENT: 324/309; 324/307

FIELD-OF-SEARCH: 324/300, 324/307, 324/309, 324/310, 324/312

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4307343	December 1981	Likes	324/309
4318043	March 1982	Crooks	324/309
4475084	October 1984	Moore	324/309
4528985	July 1985	Macovski	324/309

ART-UNIT: 265

PRIMARY-EXAMINER: Tokar; Michael J.

ABSTRACT:

The nuclei in a volume are imaged using a sequence of excitations in the presence of one or more time-varying gradient fields. The resultant phase variations are cancelled to isolate a region of the volume. Various phase-modulation functions are used to provide a desired localization function. The excitation variations can be combined with time-varying gradients during the reception interval.

23 Claims, 8 Drawing figures

☐ 31. Document ID: US 6377046 B1 Relevance Rank: 54

L1: Entry 14 of 52 File: USPT Apr 23, 2002

US-PAT-NO: 6377046
DOCUMENT-IDENTIFIER: US 6377046 B1

TITLE: System and method for interactive image contrast control in a magnetic resonance imaging system

DATE-ISSUED: April 23, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Debbins; Josef P.	Waukesha	WI		
Francis; Roshy J.	Waukesha	WI		
Prorok; Richard J.	San Ramon	CA		
Ploetz; Lawrence E.	Brookfield	WI		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
GE Medical Systems Global Technology Company, LLC	Waukesha	WI			02

APPL-NO: 09/ 590334
DATE FILED: June 8, 2000

PARENT-CASE:
CROSS REFERENCE TO RELATED APPLICATIONS The patent application is a continuation-in-part of U.S. Pat. application Ser. No. 09/200,158 by Debbins, et al., entitled "MR imaging System with Interactive Image Contrast Control", filed Nov. 25, 1998 now U.S. Pat. No. 6,166,544.

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/309; 324/314
US-CL-CURRENT: 324/309; 324/314

FIELD-OF-SEARCH: 324/309, 324/314, 324/300, 324/306, 324/312, 324/307, 324/322

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4707797	November 1987	Briggs	364/607
4830012	May 1989	Riederer	128/653
4952877	August 1990	Stormont et al.	324/312
5345176	September 1994	LeRoux et al.	324/309
5451876	September 1995	Sandford et al.	324/322
5498963	March 1996	Schneider et al.	324/309
5512827	April 1996	Hardy et al.	324/309
5541513	July 1996	Maier	324/309
5560361	October 1996	Glusick	128/653.2
5584293	December 1996	Darrow et al.	128/653.2
5606258	February 1997	Hoenninger, III et al.	324/309
5657757	August 1997	Hurd et al.	128/653.2
5711300	January 1998	Schneider et al.	128/653.2
5749834	May 1998	Hushek	600/410
5810729	September 1998	Hushek et al.	600/410
6166544	December 2000	Debbins et al.	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0 567 794	November 1993	EP	
WO 91/00530	January 1991	WO	
WO 95/34242	December 1995	WO	

ART-UNIT: 2862

PRIMARY-EXAMINER: Arana; Louis

ABSTRACT:

A magnetic resonance (MR) imaging system equipped with real-time imaging capability and method of interactively prescribing image contrast are disclosed herein. The MR imaging system includes a sequence controller for constructing MR imaging pulse sequences and a waveform memory for storing waveform segments. The MR imaging system allows an operator to interactively prescribe image contrast mechanism prior to and/or during real-time imaging. The use of image contrast waveform segments, only as needed, minimizes unnecessary MR scan time.

55 Claims, 4 Drawing figures

☐ 32. Document ID: US 20020021127 A1 Relevance Rank: 54

L1: Entry 9 of 52 File: PGPB Feb 21, 2002

PGPUB-DOCUMENT-NUMBER: 20020021127
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020021127 A1

TITLE: Method of measuring the magnetic resonance (=NMR) by means of spin echos

PUBLICATION-DATE: February 21, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Hennig, Jurgen	Freiburg		DE	

US-CL-CURRENT: 324/307; 324/309

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | KWIC
Draw Desc | Image

☐ 33. Document ID: US 6208136 B1 Relevance Rank: 54

L1: Entry 17 of 52 File: USPT Mar 27, 2001

US-PAT-NO: 6208136
DOCUMENT-IDENTIFIER: US 6208136 B1

TITLE: Method of and apparatus for nuclear quadrupole resonance testing a sample, and pulse sequence for exciting nuclear quadrupole resonance

DATE-ISSUED: March 27, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Smith; John Alec Sydney	London			GB
Peirson; Neil Francis	Northampton			GB

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
BTG International Limited	London			GB	03

APPL-NO: 08/ 916374
DATE FILED: August 22, 1997

PARENT-CASE:
This application is a continuation of PCT/GB96/00422 filed Feb. 23, 1996.

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
GB	9503807	February 24, 1995
GB	9506468	March 29, 1995

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/300; 324/314
US-CL-CURRENT: 324/300; 324/314

FIELD-OF-SEARCH: 324/300, 324/314, 324/307, 324/309, 324/318

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4438400	March 1984	Patt	324/300
5365171	November 1994	Buess et al.	324/307
5521504	May 1996	Cory et al.	324/309

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
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0 135 847	April 1985	EP	
0 145 277	June 1985	EP	
0 155 052	September 1985	EP	
0 204 569	December 1986	EP	
1 334 819	October 1973	GB	
2 200 462	August 1988	GB	
2 254 923	October 1992	GB	
2 255 830	November 1992	GB	
2 262 610	June 1993	GB	
2 282 666	April 1995	GB	
2 284 898	June 1995	GB	
2 286 248	August 1995	GB	
92/17794	October 1992	WO	
92/17793	October 1992	WO	
94/12891	June 1994	WO	

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Singh et al., "Application of the Zero-Time Resolution Technique to Nuclear Quadrupole Resonance", Journal of Magnetic Resonance, 1988, pp. 538-554.
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Buess et al., "NQR Detection Using a Meanderline Surface Coil", Journal of Magnetic Resonance, 1991, pp. 348-362.
Ageev et al., "Composite Pulses in Nuclear Quadrupole Resonance", Molecular Physics, vol. 83, No. 2, 1994, pp. 193-210.
Ramamoorthy et al., "Design of Composite Pulses For Nuclear Quadrupole Resonance Spectroscopy", Journal of Molecular Structure, 1989, pp. 333-344.

Ramamoorthy et al., "Numerical Design of Composite Pulses For Polycrystalline Samples in Pulsed NQR Spectroscopy", 1990, pp. 581-586.
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Journal of Magnetic Resonance, vol. 78, 1988, Duluth, USA, pp. 538-554, XP002009771 G.A.Singh et al "Application of the Zero-time resolution technique to nuclear quadrupole resonance".
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ART-UNIT: 282

PRIMARY-EXAMINER: Arana; Louis

ABSTRACT:

A method of nuclear quadrupole resonance testing a sample comprising a first type substance containing quadrupolar nuclei and a second type substance which may give rise to spurious signals which interfere with response signals from the quadrupolar nuclei, comprises applying a pulse sequence to the sample to excite nuclear quadrupole resonance, the pulse sequence comprising at least one pair of pulses; detecting response signals; and comparing, for the or each such pair, the respective response signals following the two member pulses of the pair, the pulse sequence being such that the respective spurious signals following the two member pulses can be at least partially cancelled by the comparison without the corresponding true quadrupole resonance signals being completely cancelled; and for the or each such pair, the two member pulses being of like phase.

50 Claims, 26 Drawing figures

☐ 34. Document ID: US 6456071 B1 Relevance Rank: 54

L1: Entry 13 of 52 File: USPT Sep 24, 2002

US-PAT-NO: 6456071
DOCUMENT-IDENTIFIER: US 6456071 B1

TITLE: Method of measuring the magnetic resonance (=NMR) by means of spin echos

DATE-ISSUED: September 24, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Hennig; Jurgen	Freiburg			DE

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Universitatsklinikum Freiburg				DE	03

APPL-NO: 09/ 906310
DATE FILED: July 16, 2001

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
DE	100 35 319	July 18, 2000

INT-CL: [07] G01 V 3/00

US-CL-ISSUED: 324/307; 324/309, 324/311
US-CL-CURRENT: 324/307; 324/309, 324/311

FIELD-OF-SEARCH: 324/307, 324/309, 324/311, 324/312, 324/314, 324/300

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5475308	December 1995	Piatto et al.	324/307
5677628	October 1997	Watanabe et al.	
5894221	April 1999	Watanabe et al.	324/307
5955883	September 1999	Hennig	
6005390	December 1999	Watanabe et al.	

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
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08252230	October 1996	JP	

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Norris D G, Ultrafast low-angle RARE: U-FLARE, Magn Reson Med. 17: 539-542 (1991).

ART-UNIT: 2862

PRIMARY-EXAMINER: Lefkowitz; Edward

ASSISTANT-EXAMINER: Shrivastav; Brij B

ABSTRACT:

A method of NMR spectroscopy or tomography, wherein a sequence of temporarily offset radio frequency pulses is applied onto a spin ensemble, is characterized in that after a sequence of pulses with flip angles .alpha..sub.1 . . . .alpha..sub.n (with .alpha..sub.1 . . . .alpha..sub.n.gtoreq.0.degree.) and phases .phi..sub.1 . . .

.phi..sub.n between which spins are dephased by .phi..sub.1 . . . .phi..sub.n, a central refocusing pulse is applied as (n+1)th pulse, followed by a pulse sequence which is mirror-symmetrical to the central refocusing pulse, wherein the flip angles .alpha..sub.n+2 . . . .alpha..sub.2n+1 and phases .phi..sub.n+2 . . . .phi..sub.2n+1 of the pulses have, in comparison with the mirror-symmetrical pulses with .alpha..sub.n . . . .alpha..sub.1 and .phi..sub.n . . . .phi..sub.1, negative sign with respect to amplitude and phase, and the dephasings .phi..sub.n+2 . . . .phi..sub.2n+1 which are also mirror-symmetrical to the central refocusing pulse in the sequence are equal to the respective mirror-symmetrical dephasings .phi..sub.n . . . .phi..sub.1 such that at the end of the pulse sequence, an output magnetization M.sub.A (Mx,My,Mz) of the spin ensemble is refocused with respect to the central refocusing pulse through application of rotation corresponding to the symmetrical relation

M.sub.R (-Mx,My,-Mz)=Rot.sub.y (180.degree.)*M.sub.A (Mx,My,Mz)

into a final magnetization M.sub.R =(-Mx,My,-Mz) (=hyperecho formation). In this fashion, even after application of refocusing pulses of any flip angles, the occurring signal losses can be cancelled and the complete signal amplitude can be regained with respect to dephasing through chemical shift, susceptibility and field inhomogeneity.

15 Claims, 24 Drawing figures

☐ 35. Document ID: US 4115730 A Relevance Rank: 54

L1: Entry 43 of 52 File: USPT Sep 19, 1978

US-PAT-NO: 4115730
DOCUMENT-IDENTIFIER: US 4115730 A

TITLE: Nuclear magnetic resonance apparatus and methods

DATE-ISSUED: September 19, 1978

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Mansfield; Peter	Chilwell			GB2

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
National Research Development Corporation	London			GB2	03

APPL-NO: 05/ 785448
DATE FILED: April 7, 1977

FOREIGN-APPL-PRIORITY-DATA:

COUNTRY	APPL-NO	APPL-DATE
GB	15295/76	April 14, 1976
GB	30187/76	July 20, 1976

INT-CL: [02] G01R 33/08

US-CL-ISSUED: 324/.5A; 324/.5B
US-CL-CURRENT: 324/309; 324/312

FIELD-OF-SEARCH: 324/.5R, 324/.5A, 324/.5B

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3789832	February 1974	Damadian	324/.5R
3932805	January 1976	Abe et al.	324/.5A
4015196	March 1977	Moore et al.	324/.5R
4021726	May 1977	Garroway et al.	324/.5A

ART-UNIT: 252

PRIMARY-EXAMINER: Tokar; M.

ABSTRACT:

A nuclear magnetic resonance spin density distribution in a sample is obtained for a selected plane or planes by placing the sample in a static magnetic field, applying a gradient to the field and simultaneously applying selective rf pulses to select a plane or planes in the sample, switching to an orthogonal gradient and simultaneously applying selective rf pulses to select strips in the selected plane or planes and then applying orthogonal field gradients to the sample of such relative magnitudes that each point of the selected strips is subjected to a resultant magnetic field of amplitude unique to that point. The free induction decay signal is then read out from the strips.

9 Claims, 27 Drawing figures

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RESONANCES.DWPI,TDBD,EPAB,JPAB,USPT,PGPB.	11554
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